SECTION 13090 - RADIATION PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Special Conditions and Division-1 Specification sections, apply to the work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of radiation protection work is indicated on the drawings. This includes, but is not limited to, the following:
   1. Lead-lined gypsum board
   2. Lead-lined doors and doorframes
   3. Lead-protected control windows

1.3 QUALITY ASSURANCE

A. National Bureau of Standards: Comply with requirements of National Council on Radiation Protection and Measurement (NCRP) Report No. 49, "Structural Shielding Design and Evaluation for Medical Use of X-Rays and Gamma Rays of Energies up to 10 MeV", as applicable to this work.
   1. Comply with requirements of local regulatory agencies where standards and criteria exceed NCRP Report No. 49.

B. Single Source Responsibility: Provide Radiation protection materials, equipment, and accessories produced as standard products of a single manufacturer regularly engaged in the production of X-ray shielding materials.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's detailed technical product information and installation instructions for each item of radiation protection and accessories.

1.5 DELIVERY, STORAGE AND HANDLING

A. Lead-Lined Door Frames: Comply with requirements of applicable Division-8 sections for Steel Door Frames.

B. Lead-Lined Wood Doors: Comply with requirements of applicable Division-8 sections for Wood Doors.

C. Lead-Lined Steel Doors with Wood Veneer: Comply with requirements of applicable Division-8 sections for Steel Doors.

D. Lead-Lined Gypsum Board: Comply with requirements of applicable Division-9 sections for gypsum drywall.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to the following:
1. Lead Lined Doors:
a. LSI / Lead Shield Company
b. MarShield, a division of Mars Metal Company
c. Pitts Little Corporation
d. Krieger Specialty Products Company
2. Lead Lined Doorframes:
a. LSI / Lead Shield Company
b. MarShield, a division of Mars Metal Company
c. Pitts Little Corporation
3. Lead Lined Windows:
a. LSI / Lead Shield Company
b. MarShield, a division of Mars Metal Company
c. Pitts Little Corporation
4. Lead Lined Gypsum Board:
a. LSI / Lead Shield Company
b. MarShield, a division of Mars Metal Company
c. Pitts Little Corporation
5. Lead-lining Accessories:
a. LSI / Lead Shield Company
b. MarShield
c. Pitts Little

2.2 MATERIALS AND FABRICATION

A. Lead Sheet: FS QQ-L-201, Grade C, thickness as indicated.

B. Lead Glass: FS DD-G-451, Type I, polished plate with a lead equivalent not less than that of system in which it is installed.

C. Lead-Lined Gypsum Board: ASTM C 36, and as follows:
1. Sheet Size: Width and length as required for support spacing and to prevent cracking during handling.
2. Thickness: Not less than 5/8 inch (16 mm), unless otherwise indicated.
a. Pressure laminate a single thickness of un-pierced sheet lead to back of gypsum board units with permanent adhesive.
b. Provide the following accessories to ensure complete installation of the shielding.
1. 2-inch (50 mm) wide lead strips for lapping at joints.
2. Lead buttons to cover screw heads.
3. Corner seam strips.
4. Electrical, switch, and outlet box liners.
5. Designation plaques.

D. Accessories and Fasteners: Manufacturer's standards, maintaining equivalent protection as system.

E. Lead-Lined Wood Doors: Comply with applicable requirements of Division-8 sections for Wood Doors.
1. Fabricate doors of solid core flush construction with one or more continuous un-pierced lead sheets to make up total lead thickness as indicated on the drawings. Apply lead

sheet constructed in the core or between the core and cross-banding at the manufacturer's option. Assemble lead lining and core with poured lead fasteners or steel bolts. Space lead dowels not more than 1 1/2 inches (38 mm) from door edge and approximately 8 inches (200 mm) on center. Countersink bolt heads and cover with poured lead.

2. Shield cutouts for locksets with sheet lead lapping lead lining of locksets and door lining, of equal thickness as used in door.
3. Furnish face veneer (red oak) of face quality and finish as required for other interior flush wood doors.

F. Lead-Lined Steel Doors with Wood Veneer: Comply with applicable requirements of Division-8 sections for Steel Doors.
1. Fabricate hollow metal doors of flush construction with one or more continuous un-pierced lead sheets to make up total lead thickness as indicated on the drawings. Apply lead sheet in the hollow metal door core and the wood veneer.
2. Shield cutouts for locksets with sheet lead lapping lead lining of locksets and door lining, of equal thickness as used in door.
3. Furnish face veneer (red oak) of face quality and finish as required for other interior doors.

G. Lead-Lined Door Frames: Comply with requirements of applicable Division-8 sections.
1. Provide additional reinforcements and internal supports to adequately carry the weight of lead-lined doors. Perform such work prior to installation of lead lining.
2. Line the inside of frames with single un-pierced strip of sheet lead of not less than same thickness as doors and walls in which frames are used. Form lead shields to match contour of frame, continuous in each jamb and across head. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective lap with the lead of adjoining shielding units.

H. Control Windows: Furnish control viewing windows where indicated on drawings. Fabricate window frame of cold-rolled steel or aluminum extrusions lead sheet lining not less than the same thickness of the lead protection in the system. Form the frame sill with horizontal trapped or baffled opening for voice passage. Construct frame to overlap lead glass perimeter not less than 3/8 inch (10 mm) and provide removable glass stops.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lead-Lined Gypsum Board: Install lead-lined gypsum board over supports as indicated.
1. Refer to Division-9 sections for metal furring and supports.
2. Pre-drill gypsum board or drill pilot holes for fasteners to prevent deformation of lead-headed fasteners and distortion of lath.
3. Apply gypsum board with long edged parallel to supports and lead lining wide and the same thickness as gypsum board lead lining to face of supports with wire nails along the outer edge.
4. Fasten gypsum board to supports with lead-headed fasteners spaced as recommended by board manufacturer. Drive fastener heads slightly below the exposed surface.
5. Overlap lead-lined gypsum board panels a minimum of 1 inch (25 mm) at all joints and corners. Extend lead overhang at least 1 inch (25 mm) into all frames or openings.
6. Install sheet lead over or behind all penetrations, cuts, or punctures to ensure continuity of radiation shielding.
7. Install lead lined accessory boxes at all electrical, outlet, and switch penetrations of the radiation shielding.

8. Wrap all pipe, conduit, and duct penetrations of radiation shielding in accordance with manufacturers recommendations and NCRP Report No. 49.

3.2 BUILT-IN-ITEMS

A. Lead-Lined Door Frames: Refer to Division-8 sections for installation requirements of lead-lined metal doorframes.

B. Lead-Lined Doors: Refer to Division-8 sections for installation requirements of lead-lined wood doors.
1. Finish hardware is specified in section "Builder's Hardware".
2. Hang doors to have a clearance of 1/16 inch (2 mm) at sides and top and minimum adequate clearance at bottom.

C. Built-In Items: Where other built-in items penetrate lead linings, provide lead shields as required to maintain continuity of shielding. Install in accordance with manufacturer's instructions.

3.3 DESIGNATING PLAQUES

A. Designating Plaques: Provide designating plaques in rooms. Indicate on plaques locations where shielding thickness of lead changes or is not continuous. Fabricate plaques form aluminum, plastic laminate or other approved material. Provide lettering on plaques as indicated on drawings or as directed by the health physicist. Provide plaques of sufficient size to contain information required.
1. Provide one sign for each room indicating thickness in millimeters of sheet lead insulation and total lead equivalent protection in millimeters of partitions, doors and lead-lined shield.
2. Rooms with Non-Insulated Partitions: Provide one sign for each lead insulated partition in a room for which all partitions are not insulated. Indicate height of sheet lead above floor or indicate partition has been insulated full height. Indicate thickness expressed in millimeters of sheet lead protection and total lead equivalent protection expressed in millimeters.

3.4 TESTING

A. After X-ray equipment has been installed and placed in operating condition, a health physicist, certified by nationally recognized agency, will test radiation shielding at the Owner's expense.

B. Testing will performed in accordance with the requirements of NBS Handbook H-76 "Medical X-Ray Protection Up to Three Million Volts". Decision of acceptability by health physicist shall be binding on contractor.

C. Repair or replace defective work, including other work affected thereby and conduct additional testing to the satisfaction of health physicist, at no additional expense to the Owner.

END OF SECTION 13090